

⑫ **EUROPEAN PATENT APPLICATION**

⑲ Application number: 83112214.8

⑤ Int. Cl.³: **B 29 D 27/00**
B 29 D 23/04

⑳ Date of filing: 05.12.83

⑳ Priority: 06.12.82 US 447352

㉓ Date of publication of application:
11.07.84 Bulletin 84/28

㉔ Designated Contracting States:
DE FR GB IT

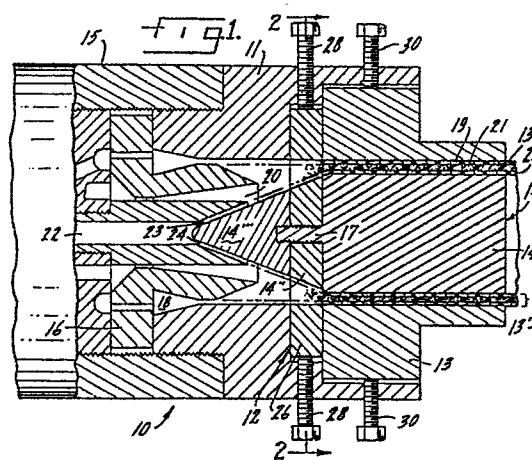
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⑤ Coextrusion feedblock for making lightweight, rigid thermoplastic pipe.

⑦ Coextrusion feedblock apparatus for making multilayer, lightweight pipe wherein means are provided to convert thermoplastic material into pipe or tubing having a plurality of layers. Means (12,28) are provided for adjusting the feedblock apparatus to assure thickness uniformity of the inner layer of the pipe or tubing and further, means (13,30) are provided for adjusting overall wall thickness of the multilayer pipe or tubing.



Our Ref.: S 728 EP
081067-M

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COEXTRUSION FEEDBLOCK FOR MAKING
LIGHTWEIGHT, RIGID THERMOPLASTIC PIPE

Description

5 The present invention relates to a coextrusion
feedblock for making lightweight, rigid thermoplastic
pipe and tubing and more particularly to a coextrusion
feedblock having adjusting means for controlling wall
thickness and uniformity in the extrusion of thermo-
plastic pipe and tubing.

10 Thermoplastic pipe made of solid plastics such as
polyvinyl chloride (PVC) and graft acrylonitrile-buta-
diene-styrene (ABS) is sold in huge quantities for use
in water supply, sanitary and storm pipes, as well as
many other applications. One great advantage of the
15 thermoplastic pipe is that it is lighter in weight than
the pipe it usually replaces or displaces; another
advantage is its ease of fabrication into fluid systems.
Its structural integrity is good for many applications,
but improvement is desired in other applications.

20 For many applications a desirable pipe is a smooth
surfaced, fluid impervious pipe of a thickness to give
it good structural integrity but light enough to have
the lightweight and ease of fabrication advantages of
plastic pipe. A simple, inexpensive and novel apparatus
25 for making such a pipe is the subject matter of this
invention.

The pipe made in accordance with the apparatus of the present invention is formed by extruding multiple layers of the thermoplastic. The extruded outer and inner layers are made of solid plastic and comprise the exterior and interior of the pipe, and the extruded center layer is made of a foamable plastic, preferably the same as the outer and inner layers.

The thermoplastic utilized in making the pipe may be ABS, PVC, phenylene oxide polymer, polycarbonate, polyethylene, polypropylene, polystyrene, polybutylene or combinations thereof. The center layer of foamable thermoplastic contains a chemical foaming or blowing agent which is incorporated into the plastic prior to charging the plastic to the extruder. Suitable foaming agents are bicarbonate of soda and citric acid, azodicarbonamide and the N-nitroso compounds. Modern Plastics Encyclopedia, 1975-1976, at pages 127-129, discloses other chemical foaming agents which can be utilized in making foamed thermoplastic materials.

The apparatus employed for carrying out the method of the present invention comprises a plurality of extruders, preferably two, connected to a single extrusion die having multiple passages for receiving and forming the plastic discharged by the extruders. More specifically, the novel aspect of the apparatus of this invention is adjusting means in the single die for controlling the thickness uniformity of the inner layer of the pipe.

A better understanding of the novel apparatus of the present invention can be gleaned from the drawings

wherein:

FIGURE 1 is a sectional view, partially broken away, of the extrusion die; and

5 FIGURE 2 is a cross-sectional view taken on the line 2-2 of FIGURE 1.

Disclosed in FIGURE 1 is the extrusion die of the present invention and designated generally by the reference numeral 10. The die 10 includes an adapter plate 11, a spider plate 12, a bushing 13 having a
10 central, longitudinal bore 13' therethrough and a cylindrical torpedo 14 disposed within the bore 13'. As shown, torpedo 14 comprises a pin 14', central section 14" and tapered end or core 14'''', all fastened together by stud means 17. The inner diameter of the bushing 13
15 is spaced from the outer diameter of cylindrical torpedo 14 to provide a passageway 13". The die 10 is attached to a feedblock 15. The feedblock 15 is shown broken away and is of the type disclosed in U. S. patent 4,125,585 as a plurality of plates. As in the aforementioned patent, the die 10 of the present invention
20 receives melted thermoplastic material from two extruders. The thermoplastic material for inner and outer layers 25 and 19 respectively of the pipe or tubing is fed to the feedblock 15 from one extruder (not shown) and center layer 21 of the pipe is fed from a second
25 extruder (not shown).

The feedblock 15 includes a core 16 which cooperates with a passageway 18 to provide a passage for and form the outer layer 19 of the pipe or tubing. A

passageway 20 is provided for passage of the thermoplastic material to form the center layer 21 of the pipe. The feedblock 15 contains a cylindrical bore 22 which has a diverging taper 23 on its inner diameter adjacent the end thereof. The bore 22 receives a tapered end 14''' of the torpedo 14 and is spaced therefrom to form a passageway 24. The thermoplastic material for the inner layer 25 of the pipe is delivered through bore 22 and passageway 24 to the die 10.

10 As will be seen more clearly by turning to Figure 2, the spider plate 12 comprises a spider body 26 and a plurality of legs 27. A plurality of evenly spaced bolts 28 are threaded through the adapter plate 11 and are in engagement with the spider body 26. Threading of the bolts 28, in or out, provides radial movement to the spider body 26 and legs 27 and thus radial movement of the torpedo 14 to which the legs 27 are in engagement. The radial movement of the torpedo 14 by the spider body 26 and legs 27 changes the passageway 24 between the tapered end 23 of the bore 22 and the tapered end 14' of the torpedo 14. Thus, uniformity of the inner layer 25 of the pipe can be obtained by adjusting passageway 24 by threading the bolts 28 in and out.

25 The bushing 13 is also radially adjustable with respect to the cylindrical torpedo 14 by means of evenly spaced threaded bolts 30. Threading the bolts 30 in and out adjusts the passageway 13" between the torpedo 14 and bushing 13.

30 In operation, thermoplastic material which has been heated to its melt temperature in an extruder (not

shown) enters the feedblock 15. A portion of the thermoplastic material passes through passageway 18 to form the outer layer 19 of a pipe. At the same time, another portion of the same thermoplastic material flows
5 through bore 22 and clearance 24 to form the inner layer 25 of the pipe.

Simultaneously, a foamable thermoplastic material is discharged from an extruder (not shown) into the passageway 20 of the feedblock 15 to form the center
10 layer 21 of the pipe.

During operation of the present apparatus, it is possible to adjust the wall thickness of the multi-layered pipe by threading the bolts 30 in and out to adjust the passageway 13". The passageway 13" may be
15 thus increased or decreased at any point around the circumference of the extrudate to provide uniform wall thickness of the finished pipe.

In addition, and more important, the apparatus of the present invention provides means for controlling the
20 thickness uniformity of the inner layer 25 of the pipe. In order to control this thickness uniformity, the bolts 28 are threaded in and out whereby the spider plate 12 moves the cylindrical torpedo 14 to relocate the tapered end 14''' within the tapered end 23 of bore 22, and thus
25 radially adjust the passageway 24 and thereby the thickness uniformity of the layer 25. The thickness uniformity of the finished pipe is maintained by adjustment of passageway 13" as described, compensating for the radial movement of the cylindrical torpedo 14.

CLAIMS

1. A coextrusion feedblock apparatus for making multilayer thermoplastic pipe and tubing comprising a feedblock (15) adapted to receive melted thermoplastic material from extruder means and feed such thermoplastic material to a coextrusion die, said die including a bushing member (13) having a central, longitudinal bore (13') therethrough, a cylindrical torpedo member (14) disposed in said longitudinal bore and spaced therefrom to provide a first passageway (18) for receiving the thermoplastic material from said feedblock, said feedblock including a cylindrical bore (22) having a diverging taper (23) adjacent an end thereof, said cylindrical torpedo (14) being tapered at one end (14''') thereof, said tapered end of said torpedo resting within but spaced from the diverging tapered portion of said cylindrical bore to provide a second passageway, (24) and means (12,28) for moving the tapered end of said cylindrical torpedo radially with respect to said diverging tapered portion to adjust said second passageway.

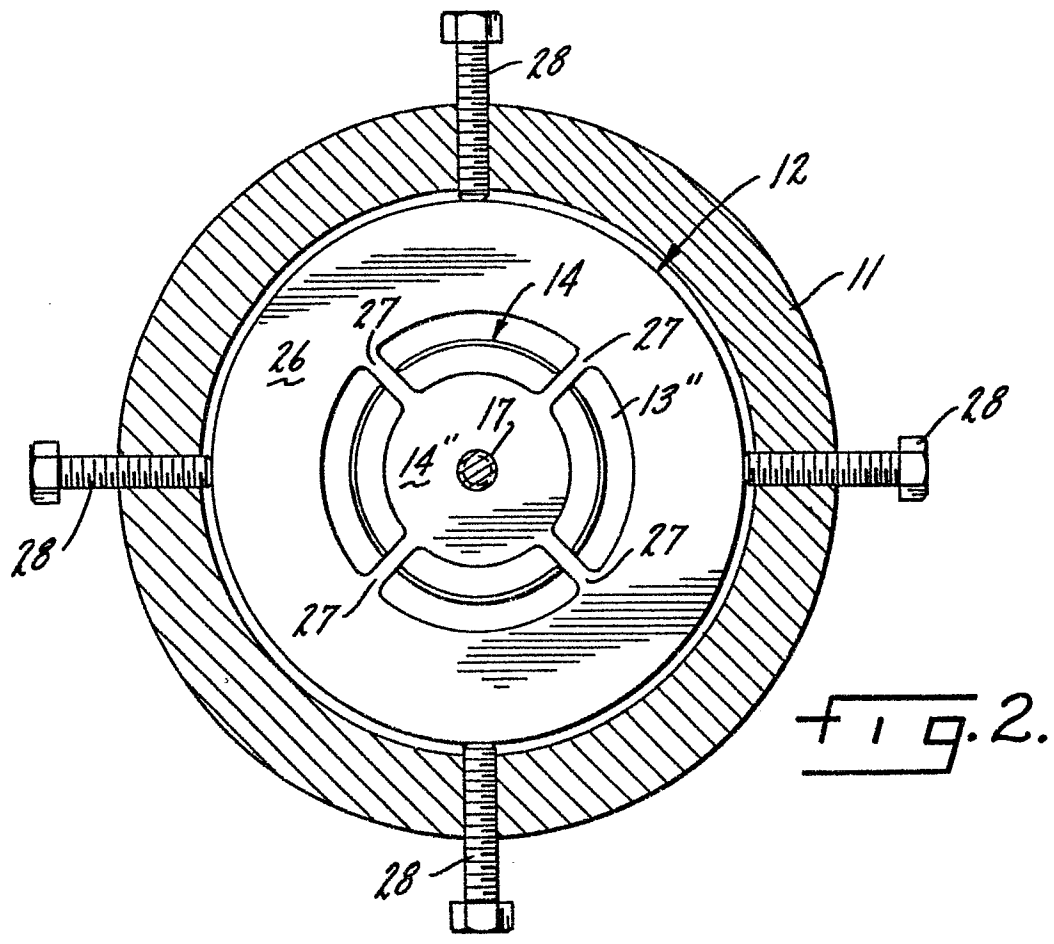
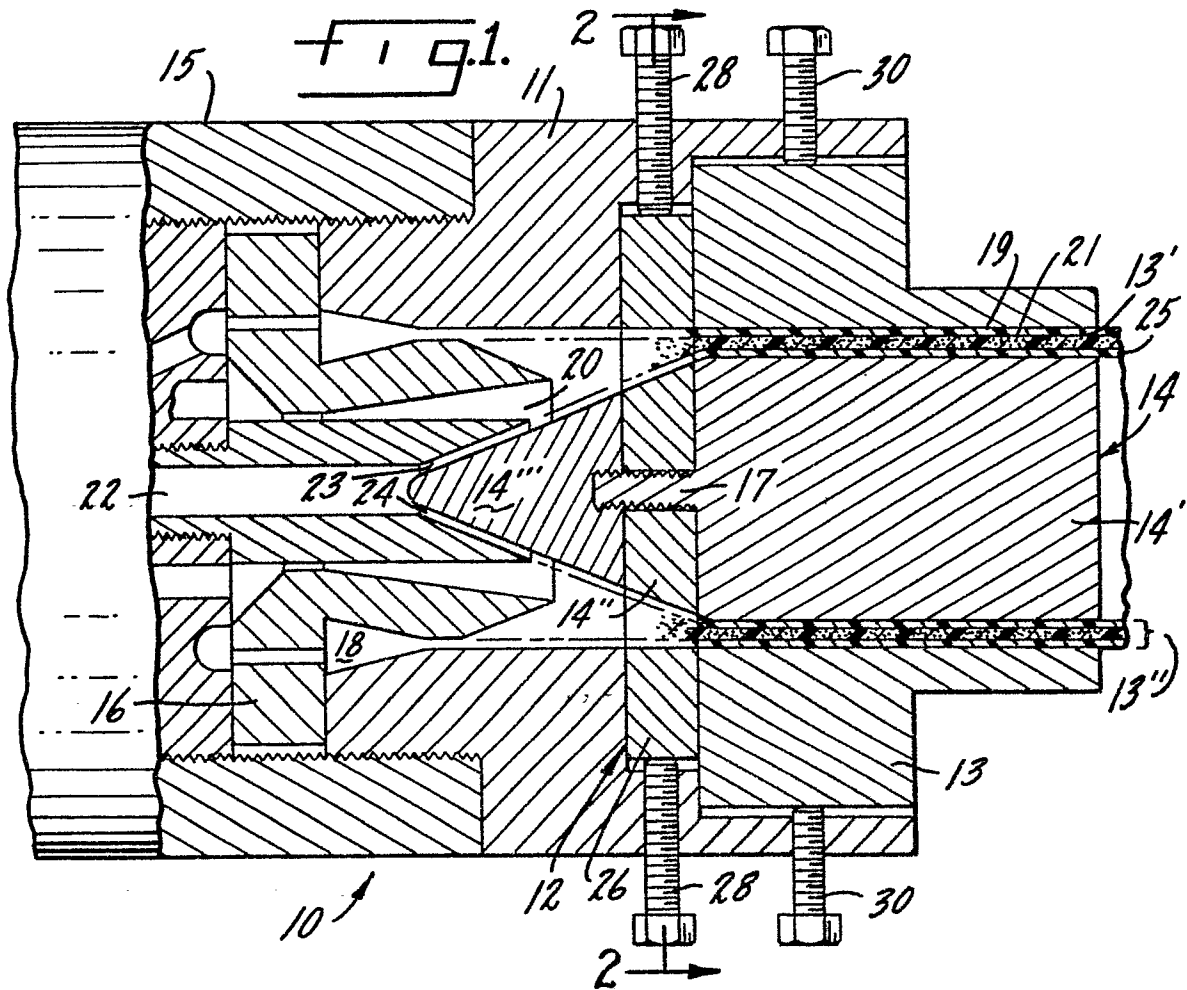
2. A coextrusion feedblock apparatus in accordance with claim 1 wherein said means for moving the tapered end of said cylindrical torpedo comprises spider means (12) in contact with said tapered end (14''').

3. A coextrusion feedblock apparatus for making multilayer pipe and tubing comprising a feedblock (15) adapted to receive melted thermoplastic material from extruder means and feed such thermoplastic material to a coextrusion die, said die including a bushing member

(13) having a central, longitudinal bore (13') there-
through, a cylindrical torpedo member (14) disposed in
said longitudinal bore and spaced therefrom to provide a
first passageway (18) for receiving the thermoplastic
5 material from said feedblock, said feedblock including a
cylindrical bore (22) having a diverging taper (23)
adjacent and end thereof, said cylindrical torpedo (14)
being tapered at one end (14''') thereof, said tapered
end of said torpedo nesting within but spaced from the
10 diverging tapered portion of said cylindrical bore to
provide a second passageway (24), means (30) for moving
said bushing (13) radially with respect to said torpedo
member to adjust said first passageway (18), and means
(12,28) for moving the tapered end of (14''') said
15 cylindrical torpedo radially with respect to said
diverging tapered portion to adjust said second passage-
way.

4. A coextrusion feedblock apparatus in accordance
with claim 3 wherein said means for moving the tapered
20 end of said cylindrical torpedo comprise spider means
(12) in contact with said tapered end.

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EP 83112214.8

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
X	FR - A - 1 492 742 (MARRICK)	1, 2, 4	B 29 D 27/00
A	* Totality *	3	B 29 D 23/04
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A	FR - A - 1 478 675 (ZILIANI)	1, 3	
	* Totality *		
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A	GB - A - 2 000 570 (COSDEN)	1, 3	
	* Totality *		
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A	EP - A1 - 0 019 564 (SOGECAN)	1, 3	
	* Totality *		
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A	DE - B - 1 907 387 (WESTERN PLASTICS)	1, 3	
	* Totality *		TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
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A	FR - A1 - 2 391 058 (BORG-WARNER)	1, 3	B 29 D 23/00
	* Totality *		B 29 D 27/00
	--		B 29 F 3/00
A	US - A - 2 501 690 (PRENDERGAST)		B 29 G 7/00
	* Totality *		B 29 H 7/20
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A, D	US - A - 4 125 585 (ROSENBAUM)		
	* Totality *		

The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 16-03-1984	Examiner MAYER

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
 Y : particularly relevant if combined with another document of the same category
 A : technological background
 O : non-written disclosure
 P : intermediate document

T : theory or principle underlying the invention
 E : earlier patent document, but published on, or after the filing date
 D : document cited in the application
 L : document cited for other reasons
 & : member of the same patent family, corresponding document